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# Numerical Modeling of Laser-Wakefield Electron Acceleration Inside a Dielectric Capillary Tube

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Laser guiding inside a dielectric capillary tube offers a promising approach for building a multistage laser-wakefield accelerator. In this approach, a relativistic electron beam, produced externally, is injected into the wakefield, excited by the propagation of the laser pulse inside a gas filled dielectric capillary tube. In the quasi-linear regime of laser wakefield excitation, the typical capillary tube length, required to achieve multi-GeV (~ 5-10 GeV) energy gain, is expected to be in the range 1-2 m.

Computationally efficient numerical simulations of laser-wakefield acceleration inside a long (~1-2 m) capillary tube are performed with the code WAKE-EP (Extended performances). This code is an upgrade of the quasi-static code WAKE [P. Mora and T.M.Antonsen, Jr., Phys. Plasmas 4, 217(1997)]. In WAKE-EP, the laser-wakefield excitation (in the quasi-linear regime) inside a dielectric capillary tube is simulated with the quasi-static approximation employed in WAKE and the acceleration of an externally injected electron bunch is described by conventional Particle-In-Cell (PIC) calculations. The capabilities of the code along with results of numerical simulations of electron acceleration to multi-GeV energies will be discussed.

**Primary author:** Dr PARADKAR, Bhooshan (LPGP, University of Paris Sud-11)

**Co-authors:** Dr CROS, Brigitte (LPGP-CNRS-UP11); Dr MAYNARD, Gilles (LPGP, University of Paris Sud-11, France); Prof. MORA, Patrick (Ecole Polytechnique, France)

**Presenter:** Dr PARADKAR, Bhooshan (LPGP, University of Paris Sud-11)

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